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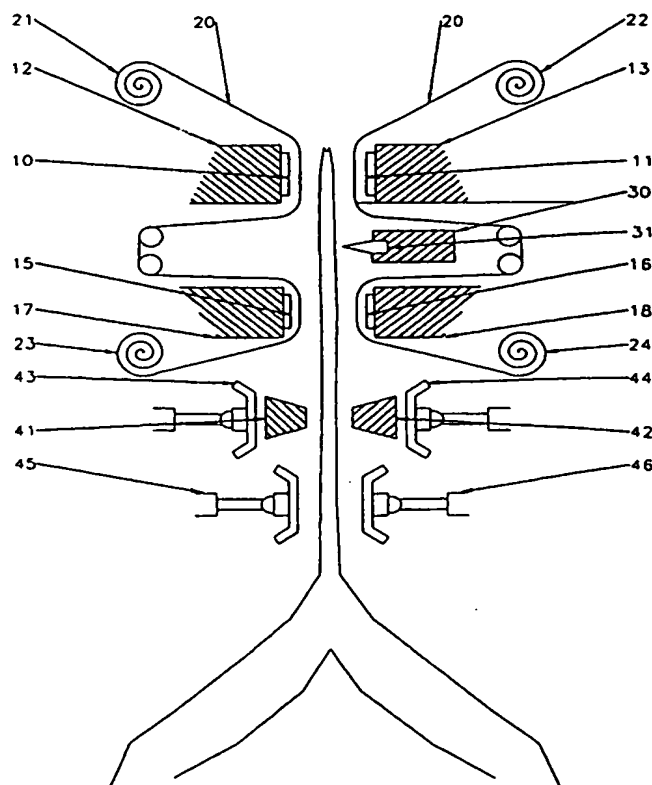
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(54) Title: APPARATUS FOR HEAT SEALING BAGS

(57) Abstract

The apparatus has an upper sealing arrangement comprising two sets of heat sealing bars (10, 11) and their support (12, 13), and a lower sealing arrangement comprising lower sealing bars (15, 16) and their support (17, 18). The lower sealing bars operate at a lower temperature than the upper sealing bars so as to seal only the inner layers of a bag together whereas the upper sealing bars can heat seal both the inner and outer layers of the bag together. An overlying protective sheet (20) of PTFE protects the heads (10, 11, 15, 16), and prevents any adherence to the neck of the bag. Perforation means (30) having a perforation bar (31) with a saw-tooth like series of projections along one edge is positioned between the upper and lower sealing bars.



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APPARATUS FOR HEAT SEALING BAGS

10 TECHNICAL FIELD

The present invention is directed to apparatus for the sealing and closure of bags. In particular it will find use with bags having multiple and separate layers of film in the neck portion. Examples are bag inside bag arrangements, where all bags are plastic – at least in the neck area.

15 BACKGROUND ART

The present invention was developed with problems associated with the packaging of powdered materials, such as milk powders, in mind though some of the problems and considerations also affect other areas and fields of packaging.

20 Traditionally milk powders have been packaged in a dual bag comprising an inner and outer bag. The inner bag typically comprises a thermoplastic material which can be heat sealed closed. This inner bag is water and dust tight and protects the contents from contamination.

25 The outer bag typically fulfils two tasks: firstly to protect the inner bag against damage, and secondly to keep the inner bag clean. In use, the outer bag, along with any soiling from transport and storage, is removed leaving the clean inner bag and contents. Typically this clean inner bag is then transported into a sterile type environment before opening. This is particularly important for the food and pharmaceutical industries.

However, to date, the outer bags have traditionally been of paper. This has always had some associated limitations though despite this it has remained the most attractive choice for the industry. The use of paper has begun to cause problems for packaged produce exported to many countries. Europe, for instance, requires re-cycling of most packaging materials. This means separate collection points and services for both the paper outer layer, and the plastic inner layer. Compounding this problem is the fact that some closure and sealing processes tape over a folded upper portion of the bag. This tape is often of a plastic material and must be physically removed, in its entirety, from the paper wrapping for re-cycling also. This complicates the opening of the package and makes it less convenient for the user.

In addition, the source of paper for the outer packaging is changing, making it less economical and convenient to rely on paper based outer packaging.

Finally, there are limitations in the type of printing and graphics which may be applied to paper packaging. Typically the type of paper used is of a relatively low quality, at least with respect to printing, and thus does not act as an effective substrate for high quality graphics advertising the product.

To address these problems, a plastic within plastic bag system has been developed for the packaging of particulate materials. Such a bag is the subject of New Zealand patent application No. 314258. However, certain other considerations have been raised. For instance, the use of different material introduces new considerations into how the package is sealed. In addition, consideration needs to be given to the ready removal of the outer bag without damage to the inner bag.

Normally the paper type bags in current use are opened from their bottom, which generally comprises a glued, or taped, over portion. Because the paper plies can readily torn and have a different rigidity to the inner bag, they can be readily removed without damage to the inner bag. However, for a protective outer bag of similar or identical material to the inner bag, such removal practices cannot be readily performed. Tearing of plastic bags is not easy and any cutting operation should be avoided for risk of penetration of the inner bag.

Finally, there are also further considerations with using plastic within plastic bags. The two often tend to slide readily with each to each other, and typically more so than between plastic and paper. Accordingly it is possible during transport or filling for the particular matter to slump (less of a problem when vacuum packaged) and for the inner bag to move about and perhaps reorient itself within the outer bag. The result is a package which may not be uniformly flat and able to be readily stacked on a pallet.

Accordingly, it may be desirable in some instances to secure the inner and outer packages at least one point.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

- 5 Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

DISCLOSURE OF INVENTION

- 10 According to a first aspect of the present invention there is provided apparatus for sealing a bag having a multiple plastic film layer neck portion, said apparatus including a first lower sealing arrangement and a second upper sealing arrangement, each disposed to be able to form a seal substantially the entire width of the neck portion and aligned substantially parallel one to the other.

- 15 According to another aspect of the present invention there is provided apparatus, substantially as described above, which also includes a protective shield positioned or positionable to be intermediate a sealing arrangement and the neck portion during a sealing operation.

According to another aspect of the present invention there is provided apparatus, substantially as described above, which includes perforation means for forming a perforation line substantially across the width of the neck portion.

- 20 According to another aspect of the present invention there is provided apparatus, substantially as described above, in which at least the first lower sealing arrangement is characterised by being able to form a seal affecting only some layers of the plastic film in the neck portion.

- 25 According to another aspect of the present invention there is provided apparatus, substantially as described above, in which each sealing arrangement comprises a heat sealing arrangement.

According to another aspect of the present invention there is provided apparatus, substantially as described above, in which the first and second sealing arrangements can have different sealing temperatures during a sealing operation.

- 30 According to another aspect of the present invention there is provided apparatus, substantially as described above, characterised such that during a sealing operation the neck portion is substantially stationary with respect to the sealing arrangements.

According to another aspect of the present invention there is provided apparatus, substantially as described above, characterised such that during a sealing operation the neck portion is travels with respect to the sealing arrangements.

5 According to a further aspect of the present invention there is provided a bag having a multiple plastic film layer neck portion which has been sealed by apparatus substantially as described above.

According to another aspect of the present invention there is provided a bag, substantially as described above, in which the bag comprises an inner plastic bag within an outer plastic bag, and whose neck portions are substantially coextensive.

10 According to a further aspect of the present invention there is provided a method for sealing a bag having a multiple plastic film layer neck portion, comprising steps of:

- (i) forming an upper transverse seal across the neck portion of the bag;
- (ii) forming a lower transverse seal across the neck portion of the bag, and
- (iii) forming a perforation line intermediate the two said seals.

15 According to another aspect of the present invention there is provided a method, substantially as described above, in which the lower seal affects only some of the multiple film layers, and excludes the outermost film layers.

20 According to another aspect of the present invention there is provided a method, substantially as described above, in which a seal is formed while the neck portion travels across relative to a sealing arrangement, and wherein the protective shield also advances with the neck portion and relative to a said sealing arrangement.

According to a further aspect of the present invention there is provided a method for sealing a bag having a multiple plastic film layer neck portion, comprising steps of:

25 (i) forming an upper transverse seal across the neck portion of the bag;

- (ii) forming a lower transverse seal across the neck portion of the bag, the lower transverse seal characterised such that the lower seal affects only some of the multiple film layers, and excludes the outermost film layers.

According to a further aspect of the present invention there is provided a method for sealing a bag having a multiple plastic film layer neck portion, comprising steps of:

30 (i) forming an upper transverse seal across the neck portion of the bag;

- (ii) forming a lower transverse seal across the neck portion of the bag, and wherein during forming of a seal there is intermediate the neck portion and apparatus for effecting said seal, a protective shield layer of a film material.

According to a further aspect of the present invention there is provided a method as described above and which includes the further steps of:

- folding the top portion of the neck portion over on itself about an imaginary transverse fold line, and
- 5 - tapping across the entire width of a least one presented outer face after folding, and around on to the other presented outer face, in a manner securing the neck portion in the folded position.

10 According to a further aspect of the present invention there is provided a bag having a multiple plastic film layer neck portion which has been sealed according to a method substantially as described above.

According to one aspect of the present invention there is provided sealing apparatus for the sealing of a bag having a multiple plastic film neck portion, said apparatus comprising at least at least an upper and lower sealing arrangement, each aligned to be able to form a seal substantially the entire width of the neck and substantially parallel
15 one to the other.

According to another aspect of the present invention there is provided sealing apparatus, substantially as described above, wherein the film neck comprises multiple films which are thermoplastic, and/or include thermoplastic portions in the region upon which said upper and lower sealing arrangements will act.

20 According to another aspect of the present invention there is provided sealing apparatus, substantially as described above, in which the sealing apparatus is arranged to interact with a bag having a neck portion including layers and/or regions of different thermoplastic properties to assist the preferential sealing of certain layers of film.

25 According to another aspect of the present invention there is provided sealing apparatus, substantially as described above, in which said perforation disc remains substantially stationary, with respect to travel in a widthways direction across the neck, and perforates the neck as the bag moves widthways through said sealing apparatus.

30 According to another aspect of the present invention there is provided apparatus, substantially as described above, in which means provided for forming a perforation is either or both:

- i) provided between the sealing arrangements, or
- ii) provided to occur before or after sealing, and optionally on apparatus associated with the sealing apparatus rather than on same.

According to another aspect of the present invention there is provided apparatus, substantially as described above, in which there is included bag neck alignment means for levelling the top of the neck of the bag prior to sealing.

5 According to another aspect of the present invention there is provided apparatus, substantially as described above, in which there is included bag neck cleaning means for cleaning the inside of the neck portion prior to sealing.

According to another aspect of the present invention there is provided apparatus, substantially as described above, in which there is included bag filling means.

10 According to another aspect of the present invention there is provided apparatus, substantially as described above, in which there is provided means for gas flushing and/or evacuation of a filled bag prior to sealing.

15 According to another aspect of the present invention there is provided apparatus, substantially as described above, characterised that a clamping belt arrangement transports a bag between different provided means for performing operations on the bag.

20 According to another aspect of the present invention there is provided a method for the closure of a bag having a multiple film neck portion, said method comprising the formation of a first seal between at least the layers of the inner most walls of the neck portion, said first seal extending substantially the width of the neck portion; forming a second seal preferably bonding all film layers of the neck portion, said second seal extending substantially the width of the neck portion; and wherein first and second seals may be formed consecutively or substantially simultaneously.

25 According to another aspect of the present invention there is provided a method, substantially as described in the preceding paragraph, wherein there is also provided separation means between said first and second seal, said separation means allowing the ready detachment of the top most portion of the neck of the bag.

According to another aspect of the present invention there is provided a method, substantially as described in the preceding paragraphs, wherein said separation means comprises a line of perforations.

30 The present invention is directed to sealing apparatus for the sealing of a bag having multiple plastic film neck portions. Embodiments of the invention may also include closure apparatus which may perform other operations associated with the closure and sealing of a package.

Typically the apparatus of the present invention is directed to bags having, at least in their neck portion, a plurality of separate film layers. This is distinct from a separate film made up of multiple layers – instead there should be substantially discrete layers, such as would be the case where there is an inner bag positioned within an outer bag.

- 5 It is possible that these discrete may be temporarily or partially attached to each other by the time they are presented for the sealing.

A preferred bag for use with the present invention is a plastic inner bag within an outer plastic bag, such as is the subject of and described in New Zealand patent application No. 314258.

- 10 The film layers referred to above are preferably of plastic or at least include plastic coatings or bonded linings able to be used for creating a seal, and preferably a heat seal.

- 15 The preferred method of the present invention is to provide at least two substantially parallel seams across the width of the neck portion. While the inner bag and its contents may be pre-sealed before being presented to sealing apparatus according to the present invention, in most cases at least one of the seals will be to close and contain the contents of the inner bag. Accordingly, it is desirable that this seal at least extend the entire width of the neck.

- 20 Typically at least a second seal is formed across the neck portion, and once again this is preferably across the entire width. In most cases the purpose of the second seal will be to help retain the various layers of the bag e.g. the inner and outer bags. This is perhaps more important where the outermost layer comprises a sleeve, rather than a bag, which is open at the other end.

- 25 With the foregoing preferred functions in mind, it is typical that the first of the two said seals is the lower seal and seals at least the inner bag. In most embodiments it is only the inner bag or layer which is affected by this seal. The second said seal is typically higher up and closer to the normal opening of the neck. Typically this seal will affect and extend through all layers.

- 30 As can be appreciated, there are variations to this arrangement. For instance, the first, lower seal could extend through all layers though for reasons to be discussed later, this may not be the preferred option. Another variation is that the second seal affecting all layers, could in fact comprise a number of seals, each of which affects various layers so that in total all layers are affected or at least restricted from separation during transport.

From preliminary trials it is considered that a preferred method of sealing the package is as described above, where the first lower seal affects only the innermost layer. By removing the topmost portion of the neck of a filled package, this removal occurring between the first and second seals, the outer bag or layer then becomes free of the inner bag – providing it has not been permanently tacked or bound to the inner bag at any other point. If the removal of this top portion, between the seal lines, is facilitated, then the innermost package with its contents can be readily removed from the outer sheath.

To facilitate removal, it is desirable to provide some means for rapidly tearing, separating, or fracturing the neck in this region. Typically some means of weakening the layers in this region, such as by the provision of perforations, is desired. Various means are known in the packaging industry though a preferred embodiment of the present invention relies on the use of a perforation line.

Where perforations are provided, there are a number of user options. For instance, the spacing and size of each perforation aperture, and their separation distance, can be varied to assist removal. In one preferred embodiment the apertures and their distance of separation are lesser near the edge of the neck so as to promote an easy initiation of the tearing process. In another preferred embodiment the perforations are each wider but also spaced closer together near the edges to promote tear initiation. Various configurations may be adopted though it is desirable that the central sections remain the strongest as it is in this region that typically the highest stresses are exerted during handling and transport.

Due to the nature of the contents, which are in most cases a substance susceptible to contamination, a problem may arise through the use of perforations. For instance, a perforation line presents a number of apertures which can allow the ingress of foreign material to within the layers. However this may be addressed by using a heated perforation forming device, where the layers become fused together about the edge of each perforation aperture. Another means is to physically protect the perforations, which may be accomplished by procedures such as taping, and/or folding etc.

Other procedures may also be used to promote tearing. This may include heating and/or cooling operations on the neck portion so as to weaken a band or region of the neck. Other possibilities include reducing the thickness of the layers in the desired region. This includes methods such as heating and/or stretching. Other possibilities exist such as affecting the physical characteristics of the film. Irradiation of susceptible films is one such possibility.

Sealing apparatus for the present invention typically includes at least one sealing arrangement, and preferably two. The preferred arrangement is one sealing arrangement for each seal to be formed, though it is possible that a single dual-sealing arrangement could be adopted, or that a single arrangement is repositioned to sequentially form each sealing band.

Each sealing arrangement may take a number of different forms. A preferred and commonly used arrangement is a heat sealing bar whose length is commensurate to the width of the neck of the bag. Typically there will be a pair of such heated sealing bars which are able to clamp the neck and form a seal between the desired layers.

- 10 Where sealing bars are used, one mode of operation according to the present invention is to halt the travel of the bag relative to the bars. In a production line this may mean physically halting the bag when it enters the sealing apparatus. Another arrangement is to have travelling sealing bars, which may comprise a set of appropriate bars on a travelling carriage which follows the bag as it continues down a production line.
- 15 However this would tend to be a relatively complicated and expensive solution, though may still be considered in some situations.

- In a situation where sealing bars are used and there is more than one seal to be formed, there will typically be more than one sealing arrangement which can act substantially simultaneously so that all seals are formed at once. This will reduce the time spent by a package in the sealing station. The other alternative is to re-position a single set of heat sealing bars (or what other arrangement may be adopted) to form both seals consecutively though again this would not normally be considered to be a cost effective (in terms of throughput) or simple solution.

- Another arrangement is to provide apparatus allowing the seals to be formed on a travelling bag. In such a situation a heat sealing bar with a suitable lead-in portion (to ensure that the travelling bag is directed to within the bars) may be provided. The length of these bars need not be the entire width of the bag. Typically they will be heated such that a seal is formed as a consequence of the heat of the sealing bars and the amount of time that a particular point on the neck portion spends travelling between the heated bars. It is possible that the bars may vary in temperature along their length.

- Another arrangement is to have a rotating disc-like sealing member which travels like a wheel over the surface of the bag forming a seal where it contacts. However, in this arrangement the point of contact between the heating disc and neck would be quite small and the time spent therebetween quite critical to seal formation. Any variations

in the rate of travel between the two could be significant (with respect to bond formation) and thus while this arrangement is still an option, it would not be preferred for most embodiments of the present invention. Such considerations would also apply for short heating bars presenting a short contact area.

- 5 It has been previously mentioned that it is desirable that there is at least two seals formed on the neck of the bag, and preferably the lower seal is such that it seals only the inner package. This may be achieved in a number of ways though the preferred method is to select different plastics materials for the different layers of the neck portion. By different is meant that the thermoplastic and sealing properties are
10 different. Accordingly, if the innermost layer was able to form a seal at a lower temperature than the outer plastic film, then the sealing arrangement for forming that particular seal could, by selection of the correct temperature, form a seal only affecting the innermost layers. The second sealing arrangement, operating at a higher temperature would of course affect all of the seals. Thus, in sealing apparatus
15 according to the present invention it is envisaged that each sealing arrangement (where more than one is provided) will be operable at different temperatures or be able to form a seal under different conditions to the other. Where only a single sealing arrangement, which is re-positionable, is provided then it will need to be able to adapt for the sealing requirements of both seals. This may cause problems where different
20 sealing temperatures are used, as thermal inertia may introduce unacceptable delays unless particular design attention is given to rapid heating and cooling.

While heat sealing is the preferred arrangement, other methods exist for the formation of a seal. For instance, microwaves may be used to heat and form a seal, while
25 ultrasonic sealing may also be considered. Again there is provision for altering the characteristics of each layer of plastic so that it is possible to form a seal between certain layers of a particular material without affecting the others. Various sealing techniques are documented in the prior art and would be known to a skilled addressee.

Another variation is to provide additional layers, coatings or modifications in the neck portion which react to certain stimuli and assist in the formation of the appropriate
30 seal. An example is to provide on the inside neck portion of the inner bag portion, a layer or coating able to fuse and form a seal with itself (on the opposing inside surface) at a lower temperature than the remainder of the bag material.

A variation based on the reverse of this is to use coatings or layers as a shield to prevent the formation of a seal. Quite simply, one or more of the layers in the vicinity
35 of the lower seal may be coated so that a seal will not form. This could, for instance, be a material able to conduct sufficient heat for the formation of the inner seal but

would not adhere to one or other of the layers. Possibilities include varnish lacquers and silicone dispersions. Shielding layers which guard against a seal being formed is also a possibility.

5 The sealing apparatus will preferably also contain means for enabling the ready removal of the top portion of the bag. As previously mentioned one of the preferred methods is a perforation line. One particular arrangement is to rely on a bar having a plurality of protrusions able to pierce or otherwise penetrate through the layers of the neck. Typically, for such an arrangement, it will be necessary to halt the progress of the bag relative to the perforating bar, in much the same manner that it was desirable to
10 halt relative travel of the neck with respect to heat sealing bars. A simple arrangement would be to position the perforating bar such that it operated at substantially the same time as the heat sealing bars. Accordingly sealing and perforation could be accomplished at the same time, though consecutive operations are also possible.

15 A second alternative method of forming a perforation line is to use a rotating disc which is able to perforate the bag as it travels relative to the disc. It is possible that a disc could be operated while the bag was stationary (during sealing) in which case it would be necessary to include means for moving the disc along the width of the neck. However, it is perhaps more effective to rely upon a substantially stationary disc which rotates and forms perforations as the bag is moved past it. This may be placed within
20 the sealing apparatus itself, such as to act on the bag as it enters or leaves the sealing apparatus. Alternatively it may be placed in associated equipment with the sealing apparatus.

There are a number of different variations for when a disc is used for forming perforations. For instance, it has been mentioned that a formed perforation line may
25 be substantially non-uniform along its length, so as to promote easier tearing at its edges. Typically this is accomplished by altering the size and/or spacing of the perforation apertures in the line.

This then introduces considerations into the design of the perforating disc. While the perforating bar may be provided with differently shaped and/or spaced teeth along its
30 length commensurate to the perforated line to be formed, this is not the only solution available for perforating discs.

For instance, it is possible that a disc may be provided with differently shaped and/or spaced teeth about its circumference which correspond to the nature of the perforation holes to be formed along the perforation line. It is also desirable, during the use of
35 such an embodiment, that the rotating disc is moved to exactly the same rotational

point at the commencement of each operation. This is to ensure that the weaker and stronger areas are consistently placed on different bags. This will also be discussed further below.

- 5 An alternative to a disc having differently sized and/or spaced teeth is to rely on a disc having identically sized and/or spaced teeth, and/or a disc having a repeating pattern of teeth about its circumference. Such types of discs, where there is uniformity or repetition of teeth shape and design, are generally less costly to manufacture and maintain. Such an arrangement is adopted in preferred embodiments of the present invention (see later).
- 10 For such embodiments, the variation and perforation size and/or shape is achieved by varying the degree of penetration of the same shaped teeth along the length of the perforation line. For instance, in a typical case where the perforation line is weaker near the edges, the teeth are pushed deeper into the neck portion of the bag. For a typical triangular shaped tooth, this results in a wider aperture and less spacing
- 15 between the next adjacent aperture. To provide for variation of the perforation characteristics along the length of the perforation line, the disc can be mounted to rotate in an eccentric manner. As can be appreciated, it is preferable if the circumference of such an eccentrically rotating disc is substantially the same as that of the length of the perforation line.
- 20 It is desirable in most embodiments of the cutting disc that each perforating operation begins at substantially the same point on the disc. Where the perforating disc is driven (and this is the preferred arrangement for performing consistent perforation lines) the wheel may be continued to be rotated, or reversed, until it is aligned at a particular rotational point. In a preferred arrangement, a magnetic clutch is used to transmit
- 25 drive from motive means to the disc and can be used to quickly halt a rotating disc at a particular rotational point. Sensor means can be used to indicate when the disc is correctly registered.
- 30 Similarly, sensor means is typically relied upon to indicate the presence of the edge of the neck of a bag at a particular point and thus signify the beginning of the perforating operation. For travelling bags, beam splitting sensors may be used.
- Other possibilities exist for weakening the layers to allow tearing and removal. An example is once again to rely upon a heat sealing means, such as a bar, to soften the plastic though not to the extent that a seal is formed. By applying a slight stretching movement while in a softened state, the layers can be weakened. Other methods have
- 35 been previously mentioned and may be implemented.

- Stretching may be performed without heating. Where used, heating may be applied by the member stretching the neck material, or by other means of directing heat into that area. Preferably such heating should be localised to the affected area. One preferred means is to rely on a roller which pushes the neck portion to the side as the bag travels past, thereby stretching a small portion of the neck in a continuous band as it attempts to pass by the roller. It is possible that this roller may be heated. It is possible that the roller may be heated by directing hot air onto it. Similarly it is also possible that hot air can be directed on to the neck portion immediately prior and/or during its interaction with the roller.
- Other modifications may be made to components of the sealing apparatus. For instance, to prevent adherence of the plastic film to the heat sealing means, it is often desirable to have a stick-resistant protective shield or coating. Often this is a polytetrafluoroethylene (PTFE) material. However, this will tend to be, by necessity to allow heat conduction, thin and can become subject to wear. Accordingly, in a preferred embodiment of the present invention there is provided a separate and advanceable protective shield film overlying the contact surfaces of the heat sealing bars. In practice this film lies between the heat sealing bars and the neck of the bag. Such a film can be advanced every so often to allow for wear. This progress may be automatic, continuous, or according to perceived need by the user or controller.
- A slightly different arrangement may be used in embodiments where a seal is formed on a travelling bag. In such embodiments, an option used in a preferred embodiment of the present invention is to have a travelling continuous loop of the protective shielding material on either side of the bag portion. Each loop is arranged so that it can travel at substantially the same speed with the bag and travels (along at least part of its path) intermediate the sealing arrangement and the neck portion of the bag. A separate loop may be provided for each of the upper and lower sealing arrangements (and/or any other sealing arrangements present), though it is typically simpler to provide a single set of continuous shielding loops which can be used in conjunction with all of the sealing arrangements.
- As can be appreciated, in this latter arrangement it is not possible to position a perforating arrangement such that it is between the sealing arrangements. Accordingly, the perforating arrangement will typically be positioned (for such embodiments) subsequent to the sealing portions of the apparatus.
- In addition, apparatus according to the present invention may include a cooling portion in which the freshly formed seals are rapidly cooled. This may be achieved by directing cool air into the vicinity of the seal of a bag. In another arrangement,

contacting heat sinks may be relied upon. These may also be cooled such as by directing cool air onto the heat sinks, and/or the use of Peltier effect devices etc. Combinations of these arrangements may also be considered.

Also used in a preferred embodiment is a pressure applying roller immediately after sealing. In an embodiment where the bag travels with respect to the sealing arrangement, less pressure is generally applied during sealing than is possible in an arrangement such as disclosed in figure 1 herein. Accordingly, the set of rollers applying pressure to the freshly formed seals, are provided immediately after the sealing process. It should be prior to the cooling portion when provided.

Typically, and especially where perforations are provided, it is desirable to cover any apertures which could collect or admit foreign material and contaminants. This may be accomplished in a number of manners though the preferred method comprises taping. In a first arrangement the sealed bag progresses from the sealing apparatus to adjacent tape application means. In some arrangements the tape application means may actually be incorporated into the sealing apparatus and could be considered an arrangement where a seal is applied to a moving bag. However, in embodiments where the bag is halted for sealing, it is generally desirable to progress the bag to a taping station so that taping can be completed while the next bag in the line is sealed. Tape may be applied in a continuous manner as the sealed bag exists the sealing apparatus, though there are a number of additional considerations.

Typically the tape is applied to cover any apertures such as perforation holes or other areas where contaminants may collect. As perforations will generally pierce the entire thickness of the sealed neck portion, it is generally necessary to apply tape on both sides of the neck. This may comprise applying two separate streams of tape, one on each side. The alternative arrangement is to apply a continuous piece of tape which wraps around both faces. However, in the first example, it may be difficult to separate the tape from the bag to initiate tearing along the perforation. In the second example, producing apparatus which transports a roller tape to cover both sides of the neck, or which moves the bag relative to the tape, would not necessarily be cost effective.

As a consequence, the arrangement in a preferred embodiment of the present invention is to fold part of the neck portion of the bag over. Here, the folding of the bag obscures the perforations on one side of the neck. This only leaves exposed perforations on the other side of the non-folded portion, which may be covered by applying tape to one side only.

As the folded over portion also creates an internal pocket, it is desirable that tape applied to one side also at least partially wrap around to cover the ends of this internal pocket formed by folding. This may be readily achieved by cutting the tape to be longer than the width of the neck, and relying upon rollers or other equivalent components to push the short extra length of tape around the edge and onto the alternate side of the package.

A further modification is to provide a non-adhesive portion on the tape to allow a user to readily initiate tape removal during opening of the package. This may be accomplished by arranging to fold a portion of tape back onto itself, or applying a non-adhesive portion onto the end of the tape at the time of folding or cutting of the tape to the desired length.

As can be appreciated, it is desirable to avoid any pockets or cavities which can collect contaminants. Accordingly, when sealing occurs, it may be desirable to ensure that the uppermost seal is as close, and preferably over, the top of the neck portion otherwise a pocket may result. This may be of little consequence if the top of the sealed bag is to be folded over and taped. Even where there is folding, it is still desirable that there is accurate alignment of the top of the bag so that seals are placed consistently at, or within a specified range of distances from, the top of the bag. It is therefore desirable to provide for some pre-alignment of the package prior to sealing.

Accordingly, closure apparatus for the present invention will preferably include alignment apparatus able to ensure that the top of the neck is level, and a consistent height before presentation to the sealing apparatus. While there are a number of possible known solutions to this problem, one preferred arrangement is disclosed in New Zealand Patent Application No. 264884 (corresponding to Australian application No. 34588/95). This comprises clamping bars and optical sensing devices which grip the top of the bag and raise and/or lower the bag to the correct height.

Transport is another consideration and again a number of means may be relied upon. While the base of the bag may be supported, slumping or shifting of the bag may mean that any alignment at the top of the bag may not be preserved. Accordingly it is preferable to support the bag at the top.

A preferred arrangement comprises the use of a clamping belt assembly in which a moving belt able to grip the neck portion of the bag travels along the apparatus. Preferably this is below the region of the neck where the seals are to be formed. Pressure is applied at various points to hold the belts together and thus apply pressure so they grip anything, such as the neck of the bag, positioned therebetween. By

releasing this pressure at certain strategic points, progress of the bag can be halted as the non-pressured belts slide past. Such an arrangement is also described in New Zealand Patent Application No. 264884.

5 Other considerations and inclusions in closure apparatus include filling means for loading the contents into a package. Again this may be part of one set of closure apparatus. Various filling arrangements known in the prior art may be relied upon.

10 Also possible for inclusion is vacuum packaging and/or gas modifying means for removing air, flushing the contents, or introducing a special atmosphere in with the contents. Such arrangements are known in the prior art though one particular arrangement is described in New Zealand Patent Application No. 264884.

15 A further consideration is cleaning of the neck prior to sealing. Some particulate matter has the tendency to coat the inside layers of the bag preventing an adequate seal being formed. Again the prior art has addressed this problem in a number of ways, including the provision of jets of gas directed into the area of the neck prior to sealing. Again this may be incorporated into various embodiments of the present invention.

20 Folding of the bag top has also been mentioned. Again, it is known in the prior art to fold edges of films and articles onto themselves as they travel past a particular point. Again prior art may be relied upon to provide a solution, such as the use of guides etc., to be able to fold the top of the bag at the required height. This may be prior to taping.

25 It is envisaged that various embodiments of the closure apparatus may take various forms. In some arrangements they may comprise discrete collections of components which collectively provide the desired result. In other instances, each portion may co-operate with others so that certain tasks are performed simultaneously, or receive attention while another task is being performed. Different situations will also require different arrangements, and may preclude the necessity for certain operations.

BRIEF DESCRIPTION OF DRAWINGS

Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

30 Figure 1 is a side diagrammatic view of a preferred embodiment of sealing apparatus;

- Figure 2 is a perspective diagrammatic view of a preferred embodiment of closure apparatus;
- Figures 3 are diagrammatic views of preferred bags for sealing;
- Figures 4 are diagrammatic views of a bag with a preferred seal arrangement;
- 5 Figure 5 is a perspective diagrammatic view of the top portion of a sealed bag whose top has been folded;
- Figure 6 is a partial cut away view of an alternative preferred embodiment of the present invention in which sealing is performed as a bag travels past the sealing arrangement;
- 10 Figure 7 is a front view of an embodiment of a perforating disc;
- Figure 8 is a cross sectional side view of an embodiment of a perforating disc assembly, and
- Figure 9 is an end view of an embodiment for stretching and weakening a portion of the neck.

15 BEST MODES FOR CARRYING OUT THE INVENTION

With reference to the drawings and by way of example only there is provided sealing apparatus (generally indicated by Arrow 1) for the sealing of a bag (2) having a multiple plastic film neck portion (generally indicated by Arrow 3), said apparatus comprising at least an upper (4) and lower (5) sealing arrangement, each aligned to be
20 able to form a seal substantially the entire width of the neck (3) and preferably, substantially parallel one to the other.

Figure 1 illustrates in cross section a preferred embodiment of the sealing apparatus. Clearly visible is an upper sealing arrangement (4) comprising two sets of heat sealing bars (10, 11) and their support (12, 13). Also provided is a lower sealing arrangement
25 (5) comprising lower sealing bars (15, 16) and their support (17, 18).

Also provided is an overlying protective sheet (20) of a suitable material, such as PTFE, to protect the heads (10, 11, 15, 16), and prevent any adherence to the neck (3) of the bag (2). Typically this sheet is fed from a roll (21, 22) and led to a second collection roll (23, 24). Preferably the collection rolls (23, 24) may be driven so as to
30 advance the film periodically, or continuously, as required.

Also provided is perforation means (30) which comprises a perforation bar (31) having a saw-tooth like series of projections along one edge. These are oriented to be able to penetrate the neck portion(3) of a presented bag (2).

Typically both the upper and lower sealing arrangements, as well as perforating means, operate simultaneously. By linking each set of components to the left, and also the right side together, all the components on a side may be advanced simultaneously with a common mechanism. It is envisaged however that other variations exist where each sealing arrangement, and/or perforating means, could be operated on - simultaneously with the others.

A number of ways exist to progress the bag though a preferred arrangement is a clamping belt assembly, generally indicated by arrow 40. This comprises two moving belts, (41, 42), which extend along the path through which the bag will travel. Pressure applying members (43, 44) coupled with clamping means (not shown for clarity) such as a hydraulic ram, are able to apply pressure to the belts (41, 42) so as to clamp the bag therebetween. By releasing the pressure on the belts (41, 42), travel of the bag may be halted as the belts (41, 42) slide past the neck portion of the bag (3).

However for this to be effective, it is generally desirable that other clamping members (45, 46) are able to secure the neck portion(3) of the bag so that it is maintained at the correct height and alignment. If necessary, clamping members could also, or instead, act on other portions of the bag, such as its main filled body portion.

It is desirable that the top of the neck portion (3) is at a preferred height, or within a preferred range of heights as well as being accurately aligned when presented to the sealing apparatus. For instance, to avoid a pocket being formed by sealing (with the upper most sealing arrangement (4)) below the top edge of the neck (3), it is desirable that the top edge of the neck (3) falls within the height of the sealing bars (10, 11), as illustrated in Figure 1. Accordingly, it is desirable that there is some form of alignment means (51), acting on the bag prior to the sealing apparatus (1). Typically, the sealing apparatus of the present invention will be combined with other portions to provide a combined closure apparatus, generally indicated by Arrow 50. This may include alignment means, which in the illustrated embodiment comprises a set of clamping bars acting on the neck of the bag and able to raise/lower each end until the top is level. Optical, or other sensing means can be relied upon.

Also included in the illustrated embodiment of closure means, and generally indicated by arrow 61, is neck cleaning and inner package evacuation or gas flushing means. These merely modify the content of the filled package accordingly, such as to either

evacuate the contents, or to introduce an inert gas. The cleaning of the neck by directing gas jets into the inner surfaces is also a consideration.

Not shown is package filling apparatus which may be included as part of the overall equipment. This may comprise means for inserting the contents into the bag according
5 to known techniques.

Shown in Figures 3 and 4 are filled bags associated with use of the present invention. Figures 3 illustrate an open bag (3) ready for sealing. Clearly visible is the inner pouch (70) within the outer bag or sheath (71). These layers remain substantially discrete and separable from each other.

10 The seals formed as a consequence of the preferred sealing operation, can be seen in the sealed bag (72) of Figures 4. Here there is an upper seal (75) which extends through all layers, a lower seal (76) which affects only the inner pouch (70), and a perforation line (77) which extends through all layers. By tearing along this
15 perforation line (77) the topmost portion of both bags may be removed. After this operation the outer bag (71) is no longer attached to the inner bag (70) which still remains sealed as a consequence of the lower seal (76). This means that the outer bag (71) can then be readily removed to expose the clean inner bag (70) and its contents.

In Figure 5 is shown a slightly different variation of a bag (80), according to the present invention, in which the top portion (generally indicated by arrow 81) has been
20 folded over. The folded over portion (81) has also been covered by tape (84) which is shown in a position where its removal has already been initiated.

Typically the tape includes a non-adhesive portion (85) to facilitate its ready removal from the reverse face (see region 86) of the package. Once the tape (84) has been removed, the top portion (81) can be folded up exposing the uppermost seal (88) and
25 perforation line (89). The package may then be opened in the same manner as illustrated in Figures 4.

Figure 6 illustrates an alternative embodiment of the present invention. For simplicity, only one half of the sealing arrangement is shown. The other portion is substantially a mirror image of that illustrated. In this embodiment of the sealing apparatus (generally
30 indicated by arrow 100) there is provided upper (102) and lower (104) sealing arrangements for forming upper and lower seals.

In this arrangement it is envisaged that the bag (106) travels continuously past the sealing arrangements (102, 104) as a seal is formed. In figure 6, the direction of travel is from right to left.

Visible is a continuous loop (108) of a protective shielding material. Preferably this is a PTFE material, or a film having an outer PTFE coating. This travels in a continuous loop such that it is present between the sealing arrangement (102, 104) and the bag (106) for at least part of its path.

- 5 At the end of the sealing process, the bag encounters a set of pressure rollers (110) biased towards each other. These apply pressure to the region of the newly formed seal so as to ensure adequate fusion.

Subsequent to this, in the region indicated by arrow 112, is a cooling portion in which cool air is directed onto the seal portion. Contacting blocks of a heat sink material can
10 also be used. It is possible that a stick-resistant coating (such as PTFE) can be applied to the contacting surfaces of the blocks.

Travel and support of the bag is provided by a clamping belt arrangement (114). This arrangement can be the same as that described for alternative embodiments of the present invention, and also such as described in NZ Patent Application No. 264884.

- 15 Figure 7 illustrates a preferred embodiment of a perforating disc (120). In the arrangement of Figure 6, the perforating disc portion may be positioned in the vicinity of the pressure rollers (110) and prior to cooling (112), though preferably occurs after cooling. Perforation is more effective and consistent if performed when the plastic is not in a weakened state, though this will also be influenced by whether the plastic in
20 the region of the perforation line has also become softened by the heat sealing process.

The perforating disc (120) is mounted to rotate in an eccentric manner. The mounting apertures (122) are shown, though their positioning has been exaggerated to show the eccentricity.

- Positioned about the disc are a number of substantially identical teeth, for which is
25 close up is shown. The adopted configuration is but one possibility, though has been found to be effective in early trials of the present invention.

Figure 8 is a side view showing the disc (120) as it penetrates into the neck portion (122) of a bag. Also shown is one arrangement of a magnetic clutch (124) coupling a mounting plate (126) for the disc (120) with drive means (128). The drive means may
30 comprise a pulley coupled by belt to another motive member used within the apparatus (such as for driving the clamping belts and/or continuous protective loops). It is also possible that the mounting plate (126) may allow for adjustment of the positioning of the disc to allow for different degrees of eccentricity.

Figure 9 illustrates an alternative to perforation. Here a roller (130) forces part of the neck portion (122) to deviate from its path, stretching it into a thinner band (132) in the process. The process may be assisted by softening the plastic by heating (such as by heating the roller (130) or directing warm air into the region).

- 5 Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof as defined in the appended claims.

CLAIMS :

1. Apparatus for heat sealing a bag having a multiple plastic film layer neck portion, said apparatus including a first lower heat sealing arrangement and a second upper sealing arrangement, each disposed to be able to form a seal substantially the entire width of the neck portion and aligned substantially parallel one to the other.
2. Apparatus as claimed in claim 1, which also includes a protective shield positioned or positionable to be intermediate a sealing arrangement and the neck portion during a sealing operation.
3. Apparatus as claimed in claim 2 which includes a protective shield comprising a film of a protective material, and wherein the apparatus allows for advance of the film such that a different portion thereof is positioned intermediate a sealing arrangement and neck portion, provision being provided for such advance either or both during a sealing operation on a bag or between operations.
4. Apparatus as claimed in claim 1, which includes perforation means for forming a perforation line substantially across the width of the neck portion.
5. Apparatus as claimed in claim 1, in which at least the first lower heat sealing arrangement is characterised by being able to form a seal affecting only the inner layers of the plastic film in the neck portion.
6. Apparatus as claimed in any one of the preceding claims in which the second upper sealing arrangement comprises a heat sealing arrangement.
7. Apparatus as claimed in claim 6 in which the first and second sealing arrangements can have different sealing temperatures during a sealing operation.
8. Apparatus as claimed in any one of claims 1 through 7 characterised such that during a sealing operation the neck portion is substantially stationary with respect to the sealing arrangements.
9. Apparatus as claimed in any one of claims 1 through 7 characterised such that during a sealing operation the neck portion is travels with respect to the sealing arrangements.

10. A bag having a multiple plastic film layer neck portion which has been sealed by apparatus as claimed in any one of claims 1 to 9.
11. A method for sealing a bag having a multiple plastic film layer neck portion, comprising steps of:
 - (i) forming an upper transverse seal across the neck portion of the bag;
 - (ii) forming a lower transverse heat seal across the neck portion of the bag, the lower transverse seal characterised such that the lower seal affects only some of the multiple film layers, and excludes the outermost film layers.

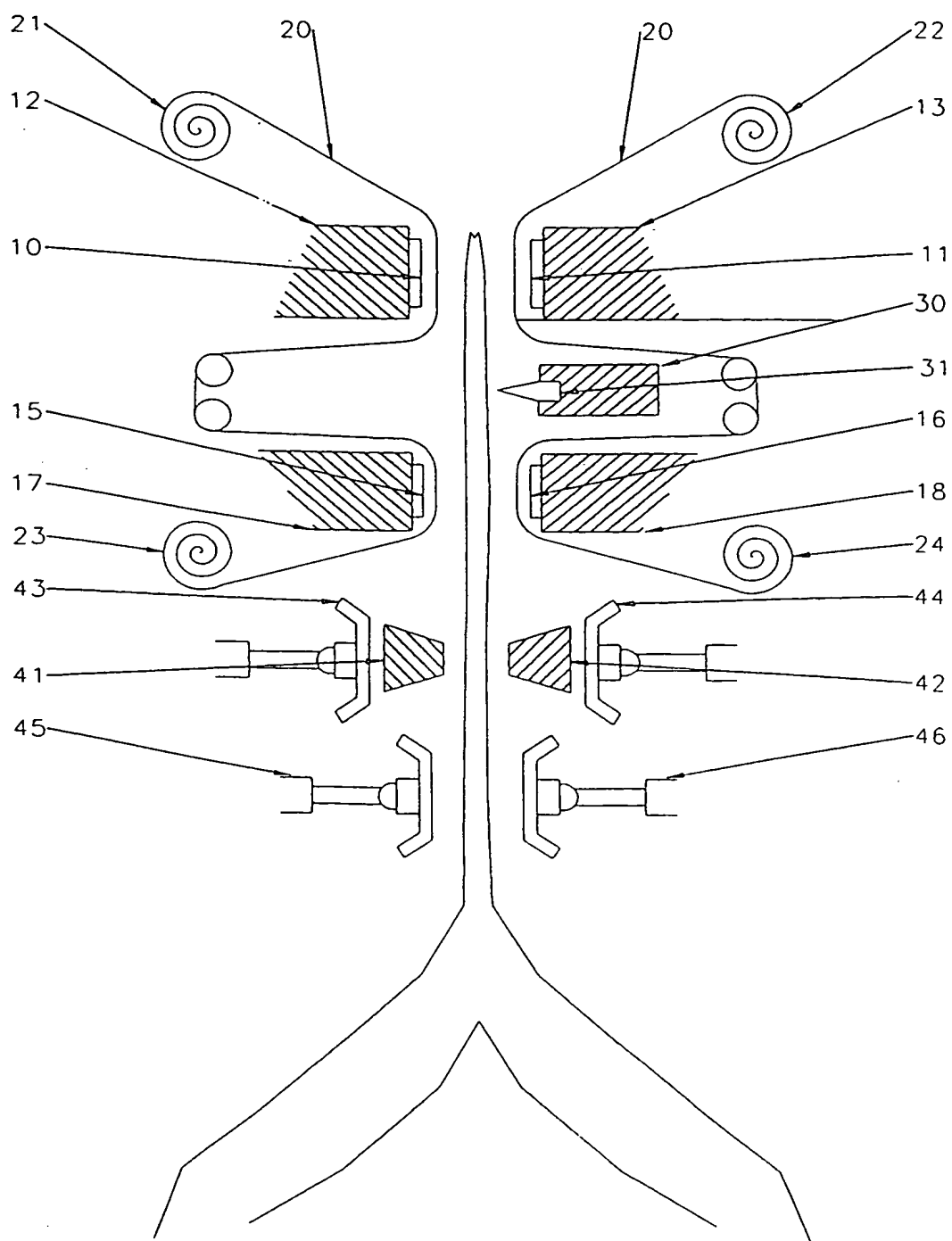


Figure 1

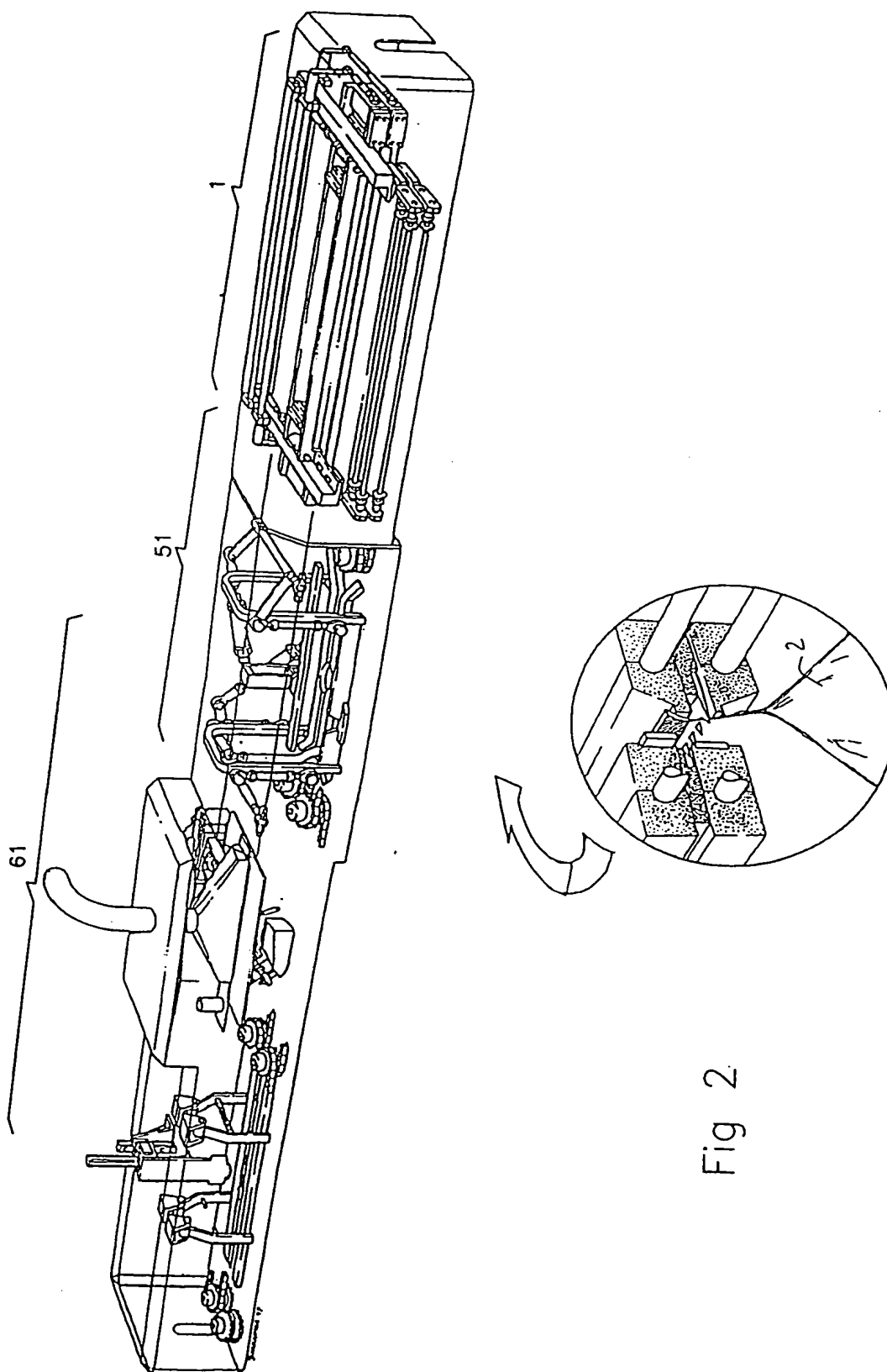
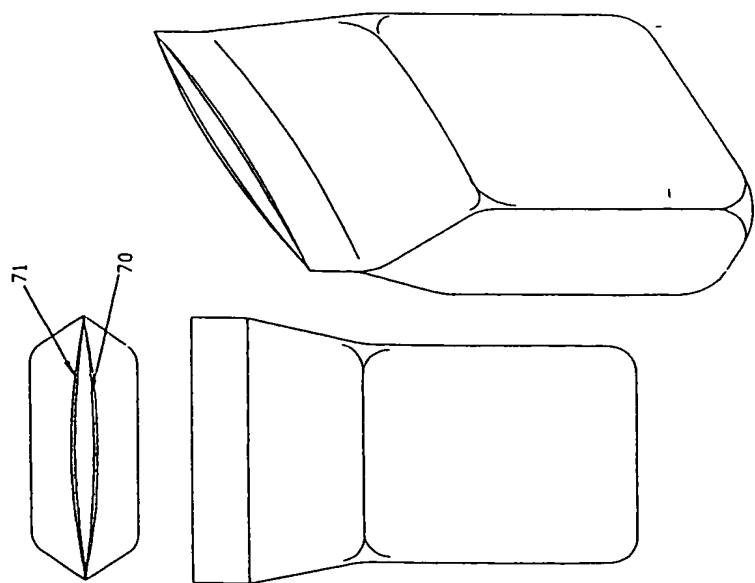
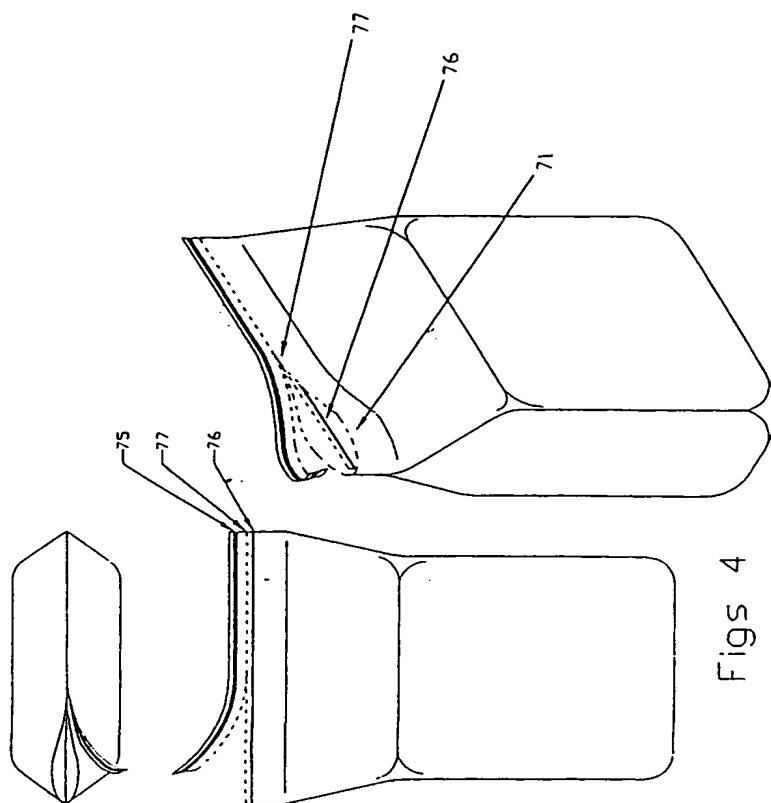


Fig 2



Figs 3



Figs 4

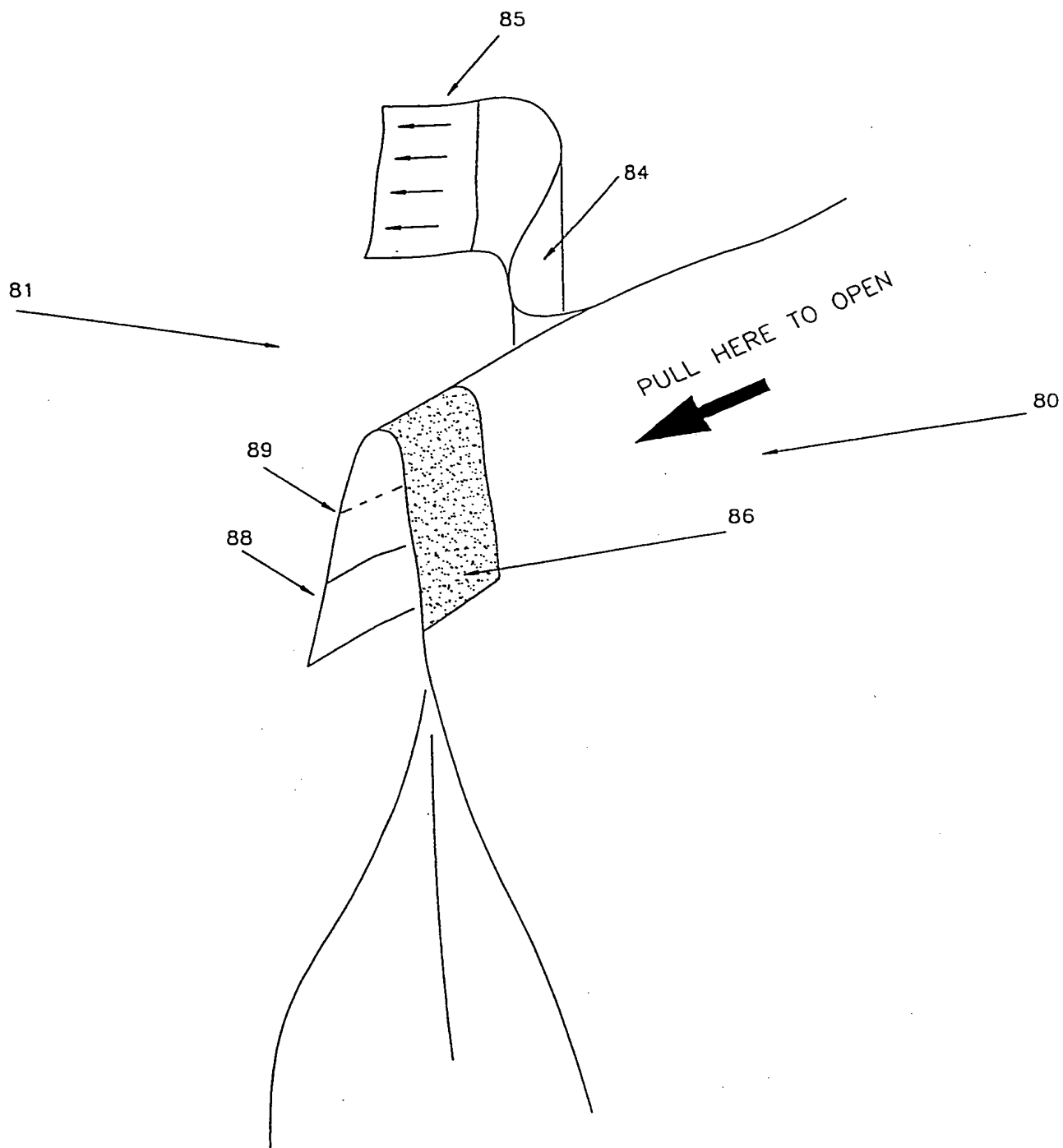
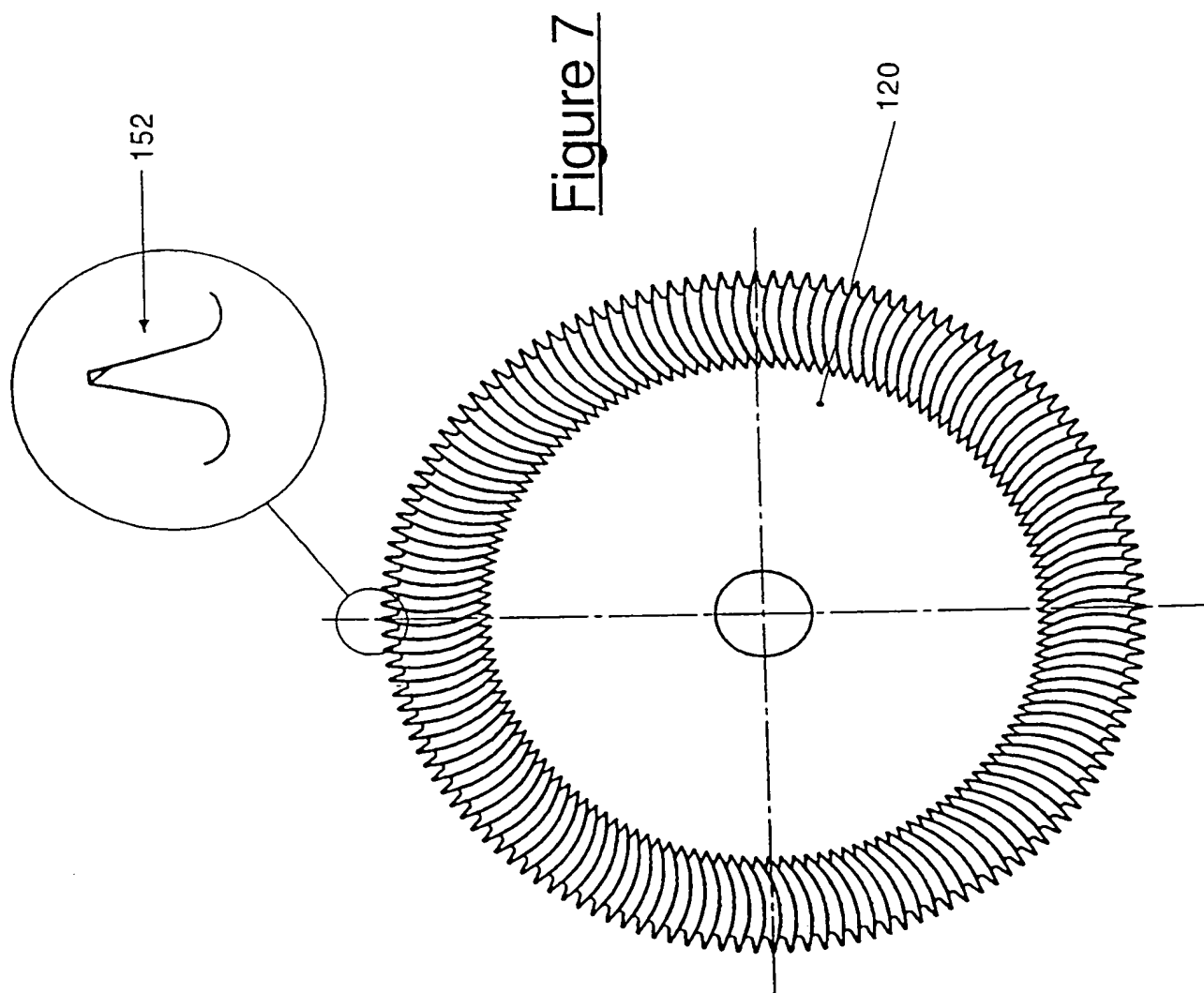


Fig 5



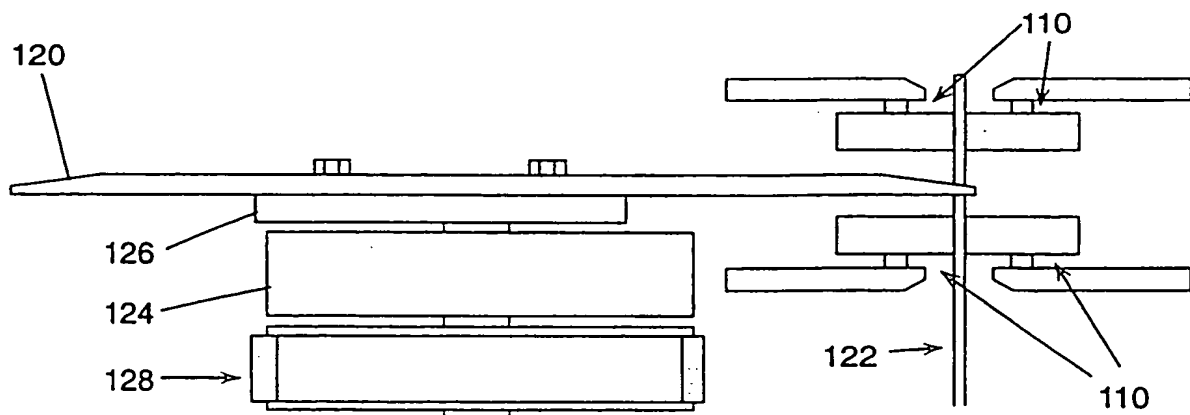


Figure 8

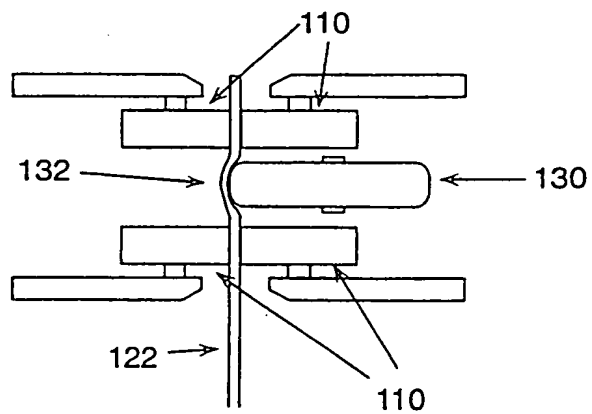


Figure 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ 98/00101**A. CLASSIFICATION OF SUBJECT MATTER**Int Cl⁶: B65B 7/06, 51/10; B65D 30/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHEDMinimum documentation searched (classification system followed by classification symbols)
B65B 7/06, 51/1-, 51/20, 51/22, 51/24; B65D 30/08, 77/04, 77/10, 77/12Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC as aboveElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, 4088264, A, (VOGT) 9 May 1978 Whole document	1
A	US, 4971454, A, (BRANSON) 20 November 1990 Whole document	1

☐ Further documents are listed in the
continuation of Box C☒ See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search
15 December 1998Date of mailing of the international search report
08 JAN 1999Name and mailing address of the ISA/AU
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